



Spatial variation in the invertebrate macrobenthos of three large Missouri River reservoirs

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With 6 figures and 5 tables

Abstract: Although benthic macroinvertebrates have been used as indicators of ecological condition for a variety of aquatic ecosystems, large reservoirs present challenges for assessment design. Reservoir embayments may have unique characteristics relevant for assessment, and the reservoirs may include zones that combine the characteristics of lotic and lentic systems. The purpose of this study was to characterize spatial variation in benthic macroinvertebrate assemblages of three large upper Missouri River reservoirs in the USA. A probability design was used to select sample sites from Lake Oahe (North and South Dakota), Lake Sakakawea (North Dakota), and Fort Peck Lake (Montana). Sites were chosen to represent the main stem of each reservoir, as well as small, medium, and large bays. The assemblages in all lakes were dominated by oligochaetes (46–60 % of total organisms) and chironomids (29–49 %). Small and medium bays generally had greater total densities, particularly of chironomids and the burrowing mayfly *Hexagenia*. Composition and density of the benthos were strongly influenced by depth. Information on the density, distribution, and variability of benthic macroinvertebrates will be used to further refine assessment strategies for large reservoirs.

Key words: reservoirs, Missouri River, assessment, bays, oligochaetes, chironomids, *Hexagenia*.

Introduction

The goal of the Environmental Monitoring and Assessment Program (EMAP) is to develop the tools needed for scientifically-defensible assessments of aquatic ecosystems of the USA (McDonald et al. 2004). Two hallmarks of EMAP are probability-based sampling designs and the use of biological indicators of ecological condition. The EMAP approach has been successfully applied to streams, rivers, lakes, estuaries, and wetlands (McDonald et al. 2004), but not to large reservoirs. Reservoirs present unique problems for development of assessment designs and indicators. Large reservoirs often combine the physical characteristics of lotic and lentic systems (Thornton 1990), and existing designs for lakes or rivers may not be optimal. Although

benthic macroinvertebrates have been used as indicators of condition for a variety of aquatic ecosystems, the assemblages of large-river reservoirs require further characterization before we can develop reliable indicators. A feature of reservoirs that impacts ecological assessment is their high spatial variability. Longitudinally, environmental conditions range from riverine (lotic) at the inflow to lacustrine at the dam (Thornton 1990). Laterally, flooded tributary valleys form bays which may have conditions very different from the main body of the reservoir, depending on flow conditions (Kimmel et al. 1990). In this study we used a probability-based sampling design to characterize benthic macroinvertebrate assemblages in open water and bays of three large reservoirs of the upper Missouri River: Lake Oahe, Lake Sakakawea, and Fort Peck Lake.

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